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SEASONAL VARIATION OF HOUSEHOLD FOOD WASTE IN DENMARK

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ABSTRACT. This paper analysed the influence of seasonal variation in the generation of the Danish household food waste. Residual household waste was sampled and manually sorted into six food waste fractions. Vegetable food wastes were the main fraction contributing to the household food waste. Statistical analysis showed a significant relationship between avoidable food waste and household size. However, there were no significant seasonal differences in the amount of avoidable food waste.

Keywords: Manuscript; template; conference; Hong Kong

Introduction

Food waste causes unnecessary greenhouse gas emissions, spoiled water and land (Lipinski et al., 2013). For example, the production and distribution of food for human consumption that is wasted or lost accounts for use of 24% of the total freshwater resources, 23% of the global cropland area and 23% of the global fertiliser consumption (Kummu et al., 2012). This situation may threaten food stability and food security. Therefore, numerous public authorities are increasingly committed to considerably reduce food waste through food waste prevention.

To evaluate the current food waste situation and to enable any evaluation of the performance against the target indicators, data on food waste generation and composition are required. Additionally, a better understanding of the seasonal patterns of household food waste generation is crucial in designing and implementing a successful awareness-raising program about prevention and avoidance of avoidable food waste.

This paper presents data on the quantity and composition of the Danish households 'food waste with the aim to identifying general characteristics, as well as any correlation with season and household size.

Material and Methods

Waste management system in the study area

The waste sampling campaign involved single house area in Denmark. In this study area, food waste is not source-sorted and it is disposed of in the residual waste bin. For this reason, the residual household waste was used for the waste stream analysis.

Waste sampling and sorting

In this study, households were selected with the aim to obtain a representative sample for the study area. To minimise errors related to change of household behavior related to the food waste generation during the sampling campaign, residual household waste was collected following the normal schedule of waste collection. The waste was collected in winter, spring and summer from the same households.

The waste collected was the residual household waste that was actually disposed of by household during these sampling periods.

The residual waste was sampled at household level from 221 households. The collected waste was generated during one week. The sample size and the collection period are based on the Nordtest sampling methodology (Nordtest, 1995).

The waste from each household was sorted separately into six food waste fractions shown in Table 1 and described by Edjabou et al (2013) (Table 1).

Table 1: Food waste fraction and examples

| Food waste fractions | Waste components |
|---|---|
| Avoidable unprocessed vegetable food waste | Rice, pasta, potatoes, etc. |
| Avoidable processed vegetable food waste | Fresh fruit, fresh carrots and potatoes, bread, cereals, etc. |
| Unavoidable vegetable food waste | Residues from fruits, vegetables, coffee grounds, etc. |
| Avoidable unprocessed animal derived food waste | Leftovers containing meat, fish, skins and bones, etc. |
| Avoidable processed animal derived food waste | Cooked eggs, rest of food containing meat, fish, etc. |
| Unavoidable animal derived food waste | Eggs not cooked, dairy products, not cooked meat and fish, etc. |

Source: (Edjabou et al., 2015)

Statistical analysis

The aim of the statistical analysis was to reveal how the measured differences in the food waste generation rates might have been influenced by seasonal variation. In this study, we mainly focused on the avoidable food waste. This was achieved by mean of an analysis of variance

(ANOVA) (Reimann et al., 2008). Data on household food waste was analysed using the statistical software R (<http://www.r-project.org>).

Results and Discussion

Food waste composition

Table 2 shows the composition of food waste as function of seasons. The average total food waste amounted of $44 \pm 17\%$ of residual household waste, of which $23 \pm 15\%$ for avoidable food waste and $21 \pm 12\%$ for unavoidable food waste. These results are in line with those found in previous Danish studies (Edjabou et al., 2015; Riber et al., 2009).

The food waste compositions as function of seasons were also comparable to the average food waste composition as it is shown in Table 2. For example, the percentage of avoidable food waste found in summer ($23 \pm 15\%$), autumn ($21 \pm 12\%$) and winter ($22 \pm 15\%$) were similar to the average values.

Table 2: Food waste composition as function of season (percentage wet mass waste)

| Food waste | Summer ^b | Autumn ^b | Winter ^b |
|----------------------------|---------------------|---------------------|---------------------|
| Avoidable food waste (%) | 23 ± 15 | 22 ± 15 | 23 ± 14 |
| Unavoidable food waste (%) | 20 ± 11 | 23 ± 13 | 18 ± 11 |
| Rest ^a (%) | 57 ± 17 | 56 ± 18 | 59 ± 18 |
| Total | 100 | 100 | 100 |

^a Residual household food waste minus total food waste (avoidable and unavoidable food wastes)

^b Percentage mass per wet basis as mean \pm standard deviation

Food waste generation rates

Figure 1 shows the boxplots that summarise the waste generation rates of avoidable food waste as function of season. Apparently, the amount of avoidable food waste per household tends to increase with the size of the household (number of occupants per household). While analysing the detail food waste fractions, we found that, vegetable food waste was dominating the food waste fractions and consisted of avoidable unprocessed vegetable (28 ± 42 kg per household per week) and unavoidable vegetable food wastes (39 ± 42 kg per person per week).

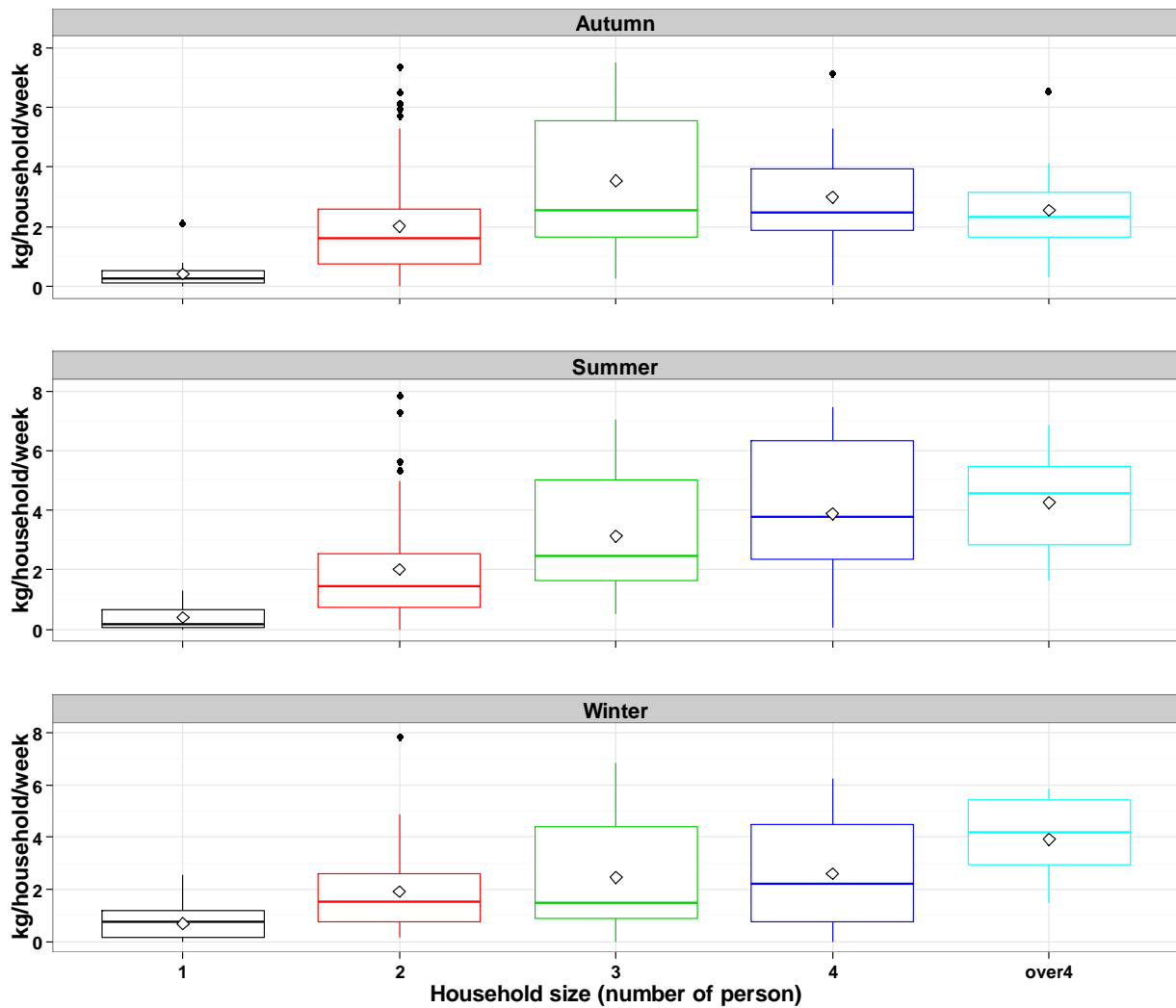


Fig.1. Summary of avoidable food waste generation rates as function of season

The statistical analysis revealed that the amount of unavoidable food waste expressed as wet mass per household per week increases significantly with the size of the household (df (degree of freedom)=4, p -value= <0.001), whereas the amount of avoidable food waste expressed as wet mass per person per week significantly decreases with the size of the household ($df=4$, p -value <0.001). However, there were no significant differences in the amount of avoidable food waste between seasons ($df=2$, p -value >0.5). These results suggest that household food waste is not influenced by the seasonal variation. This could be explained by the continuous availability of different category of food products throughout the year. For example, in recent year, the seasonal vegetables and fruits are sold during the whole year.

Conclusions

The analysis of Danish residual household waste showed a significant relationship between the amount of avoidable food waste and the number of occupants per households, while season had no significant influence on the amount of avoidable food waste.

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